Energy provision for the urban poor: South African country case study

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ABBREVIATIONS

DBSA	–	Development Bank of Southern Africa
DFID	–	Department of International Development, UK
FINESSE	–	Financing Energy Services for Small-Scale Energy Users
IT	–	Intermediate Technology
LNG	–	Lwandle Negotiating Group
LPG	–	liquefied petroleum gas
NER	–	National Electricity Regulator
RDP	–	Reconstruction and Development Programme
SADC	–	Southern African Development Community
SALDRU	–	Southern African Labour and Development Research Unit
SANCO	–	South African National Civics Organisation
SWH	–	solar water heater
SWH	–	solar water heater
UNDP	–	United Nations Development Programme
USAID	–	United States Agency for International Development
VAT	–	value-added tax

EXECUTIVE SUMMARY

Urban poverty is a severe and growing problem in South Africa. The rate of urbanisation is increasing and the new democratic government and local authorities are struggling with a lack of capacity and inadequate funds to address the historic backlog of housing and services, health and education for the 50% of the population who are poor and currently without these facilities. The liberalisation of the economy and opening up of the previously closed and protected markets has seen the number of unemployed increasing while the population continues to grow.

South Africa has a relatively strong industrial base and has Eskom, the world's fifth largest electricity utility. Eskom generates electricity largely from the country's substantial coal reserves. South Africa produces its own oil (albeit at high cost), has the potential to tap into the gas fields of Mozambique and Namibia (or produce its own biogas), and has adequate biomass resources (albeit in places inaccessible to people). Therefore access to energy in South Africa is not so much a resource problem as a challenge of redistribution of these resources so that all may have access to them. This is a key national issue which requires considerable political will to address.

Considering the provision of energy services to urban low-income households is a new initiative in South Africa at the macro-level. The main strategy for this has been the mass electrification programme which has been partially successful, as described in this report. A strong and viable Eskom, in conjunction with a number of local authorities, has been able to electrify more than two million households since 1991. 'Electricity for all' was a 1994 electoral promise, and most South Africans expect to have electricity regardless of whether they can afford to use it every day.

The average cost per connection was about R3 250 in 1996 including the ready-board and pre-payment meter. This will increase over time especially over distance (that is, in rural areas). Depending on the area, customers pay an energy tariff of about 28c/kWh (Banks and Thom1998:13). However the entire programme is massively subsidised by Eskom, which is a parastatal, so customers pay only a nominal fee of R50–R140 (this varies between provinces) to be connected. This accelerated programme was planned to last until 2000, after which it will slow down, and the rate of electrification will also be affected by the Eskom's re-structuring – a process which is already underway, and sees, for example the utility having to pay taxes which was not obliged to do previously.

Electrification is limited to those households which have legal tenure, something which excludes many informal houses in urban areas. Thirty per cent of urban dwellers are without electricity, and even those who are connected continue to use a combination of energy carriers including electricity, LP gas, paraffin and wood. The energy needs of these households at the 'bottom of the pile' need the most attention.

The first part of the report focuses on the relative success of the technology designed to minimise billing costs to the utility – prepayment meters and ready -boards.

Case study 1a reveals the relative success of pre-payment meters in meeting the payment requirements of suppliers. Although meters may be tampered with and by-passed, on the whole rates of payments have improved and households with unmanageable arrears have opted to have pre-payment meters installed and pay off their backlogs over time rather than be disconnected. From the customer's point of view, pre-payment technology enables the purchase of electricity in small denominations to suit unpredictable incomes, and the ability to monitor energy use and adjust appliance use accordingly. Energy use patterns change once customers have the information and the visible evidence of what appliances use most electricity, with the most noticeable being switches from electric to paraffin heaters.

The disadvantages of the pre-payment system are that are that they are packaged with a ready-board with one light and three plug sockets which may be dangerously overloaded and extended by 'street electricians'. One light fitting is not sufficient for the whole dwelling and so people are still using paraffin and candles with the accompanying health and safety hazards. Pre-payment technology is locally developed and is constantly being improved.

Alternative forms of energy provision have received growing attention and interest. Because of the need to reduce poor people's spending on thermal applications and reduce health and environmental costs, as well as keep an eye on peak loads, three projects which attempt this are reported: two solar

water system projects in Ivory Park and Lwandle, and a low-cost housing scheme which used passive solar designs and insulated building materials.

Case studies 2, 3 and 4 describe such pilot projects. Case study 2 describes the UNDP/ SADC energy sector initiative to supply solar water heaters to a new low-cost housing scheme in Ivory Park in Gauteng province. This project could not be implemented beyond the pilot phase because the key stakeholder, MidDev local council, decided it was not a priority.

Case study 3 documents the installation of solar water heaters in Lwandle Hostel as part of a hostel upgrade project and attempt to develop five energy-orientated small businesses. This project demonstrates the general problems associated with solar/PV projects in South Africa to date. Solar and PV technology is still relatively expensive in South Africa and has achieved limited success. It is not subsidised, so each project has to attract funding, usually international, and cannot always be replicated.

Other problems include that the fact that hot water metering and monitoring prototypes will not provide an adequate cost recovery, and the combinations of technologies being tested for the first time, solar water heaters (SWHs) and thermostatically controlled LPG-in-line water heaters, will not be as compatible as they appear theoretically. The small businesses to be set up around the provision of affordable hot water services have yet to prove themselves.

In case study 4, the binational agreement between the USA and South Africa led to a participative housing project at Kutlwanong where passive solar design houses were built using the first-time owner's housing subsidy of R17 500, assisted by the goodwill of the local municipality. Community participation and ownership of the scheme seems to have been an important element in its success. The degree of participation achieved was largely due to the community's own ability to organise and mobilise, and the conception of the project as not just an energy input, but a holistic approach to development, including capacity building and skills training.

Although PEER Africa are willing to try and replicate the project, it would appear that a suitable site with all conditions necessary (an organised community, a site and service scheme with government subsidies and municipal backing) has been not been found.

The lessons to be learnt from all three attempts at participative projects is the slowness of the process where many stakeholders are involved, and the crisis engendered by a single withdrawal. The Kutlwanong project was the most successful, but it also demonstrated that building energy-efficient houses is a slow process requiring negotiations with different stakeholders. In addition it is important for developers to learn from each other's experiences.

The cost-savings associated with the solar water heaters are only an advantage in houses which have pressurised water. It is important that back-up systems work efficiently in the cold, wet winters of the Western Cape, otherwise solar technology gets a bad name for not meeting needs. As shown in these three case studies, barriers to implementing energy efficiency technologies generally relate to high entry costs, lack of awareness about possibilities, and the need for community commitment.

The third focus of the report is small-scale enterprise. The informal sector is that part of the economy which is supposed to offer most opportunity to poor people to make a living, and the report gives three case studies of individuals and groups of people engaged in small-scale enterprises where energy is central to their viability. Historic neglect of this sector means that there have been no quantitative assessments of the contribution of energy to these enterprises. This still needs to be done.

Selling food is one of the most widespread small-scale enterprises and it requires considerable energy input. Indications are that electricity is too expensive for the heating required for the preparation and cooking of many foodstuffs (for example sheep heads) so wood is used instead. The social barrier to wood use in urban areas falls away when it is used for income generating activities. That is to say, households that avoid using wood for domestic purposes (meals, making tea) because they do not want to be regarded as (very) poor or rural, have few qualms when it comes to using wood for brewing beer or cooking chickens or sheep's heads.

Interviewees have complained that wood resources are diminishing, but it is not yet known at what stage any other energy source may be substituted. It is clear that an electric stove with limited pot space and expensive current would just not serve the same purpose.

Case studies 5 and 6 represent the beginning of the qualitative study of wood use and collection, but we need to have a better understanding of the movement and uses of quantities of wood before solutions can be found. Policy recommendations for open space provision in urban areas, which include urban woodlots, are currently on the table, but whether these will be implemented and supply the wood required remains to be seen.

Case study 5 is a good example of the labour and energy-intensive activities many women engage in for uncertain profit. Primary inputs into the products of the woman in this study are labour, the ingredients, wood and transport. Any change in any in the inputs, such as cutbacks in the number of trains, may upset the balance and render the enterprise unviable. The ready market is the one factor in her favour. She extended her range of products to include fat cookies, but she is limited in her ability to exploit this further because she has no way of preparing or transporting more. Looking to extend her business may be looking in the wrong direction; her anxiety is simply to be able to maintain it, which is actually the crux of the matter. Ways of maintaining her health, the availability of wood, and a low inflation rate and adequate public transport so that she can maintain here business at stable costs, may be more difficult to think about and achieve than imagining exciting ways of expanding her business.

Case study 6 is somewhat different in that it documents the attempt of a group of informal traders, an NGO and six major funders (national and international) to provide appropriate facilities for informal traders to sell their wares with an emphasis on empowerment, skills training and the integration of hostel dwellers into the broader community (Mqela 1997).

The need to provide appropriate facilities for the meat market was perhaps the primary driver, but the market is big enough for 110 traders for all types. Only about half the stalls are currently occupied, although careful participative processes have ensured that all necessary stakeholders were involved. The main barrier to greater occupancy seems to be the commitment to paying regular rent, and the main barrier to expanding current business seems to be a lack of transport. Skills training, deemed necessary in the project proposal stages, has not been a priority with the traders who are under pressure to keep their enterprises going and cannot afford to take time out.

Wood plays an important role in the meat market – it is used for cooking fires on the spot and social fires for beer drinkers in winter. A trade in wood has been observed, but no attempt has been made as yet to quantify or qualify this.

Case study 7 is one of the few documented examples of a small-scale enterprise which involves wood collection and selling. As with the commercialisation of many activities, wood collection in this case becomes men's work. Although pensioners, two men have the ability to buy donkeys and a donkey cart so that they can collect, cut and sell wood. Again the enterprise is a fragile one – there is not sufficient profit in the business to replace a donkey, so when one died, the enterprise collapsed. Another reason for abandoning the enterprise was that the 'forest' was 'too far nowadays' but this perception needs to be checked and measured.

What the three case studies on small-scale enterprise demonstrate is the precarious nature of these activities. Any intervention which upsets the dynamics or balance of inputs which are currently functional, however well-intentioned, may render the activity no longer viable. It is not always clear from our studies whether there is a profit from micro-enterprises and how much it is, or whether turnover is what keeps activity alive. Although the profitability of many small-scale enterprises is dubious, they serve personal and social purposes beyond profit-making. Ways of securing current energy use patterns may be more useful than attempting to change them. Perhaps only when large numbers of poor people are secure can transitions to 'higher grade' energy sources or rented space or skills training be secured too.

CONTENTS

1 Introduction

This report addresses energy service provision to the urban poor in South Africa, with a special focus on low cost electrification and energy for small-scale enterprise. The report is divided into the following sections:

- South Africa: the context
- An overview of the South African energy sector
- Low cost electrification
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    - Case study 1b
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- Energy-efficient initiatives
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    - Case study 3
    - Case study 4
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    - Case study 6
    - Case study 7
- Conclusion and recommendations

The first section gives a brief introduction to the broad socio-economic trends in South Africa and sets the scene for understanding the current levels of urban poverty. The second section looks briefly at the South African energy sector and the place of domestic energy within in it, with the focus on poor households. The third section describes the national accelerated electrification programme with special emphasis on urban electricity delivery to the poor, and the use of pre-payment meters. This section is elucidated by case study material drawn largely from research done by Mehlwana and Qase, consisting of first-hand interviews in which the economics of energy use, and the social, health and environmental issues are raised and commented upon.

The mass electrification programme is not going to reach all urban or rural households. Studies show that even those who do get connected to the grid are unlikely to be able to afford to use electricity for all thermal applications, and are likely to continue to use paraffin or wood for space heating with the associated health and safety hazards. Electricity is expensive and inefficient for space and water heating in a country which has so much sun. The fourth section of the report looks at the projects piloting energy efficiency in urban areas and offers case studies of space and water heating.

The fifth section examines the use of energy in small-scale enterprises. Case studies used to illustrate this section also come largely from research done by Mehlwana and Qase, which, although it was not commissioned or designed specifically to explore energy use in small-scale enterprises, is one of the few studies in South Africa to do this. The historical neglect of the black population's survival enterprises means there has been no research which focuses solely on urban energy use in small and micro-enterprises in South Africa. In addition there are no national (or even regional or local) statistics available on energy consumption (wood, paraffin, gas and electricity) for small-scale enterprises. The work documented here is only the beginning of our research and recommendations, and is one of the research areas for which we are currently seeking funding.

The sixth and final section of the report seeks to draw recommendations and conclusions.

Before proceeding with the body of the report, it may be useful to reflect on the notion of increasing access for the urban poor to 'higher grade' forms of energy. The report as a whole reflects the importance and likely continuation of multiple fuel use in poor urban households, even those that have been electrified. The cost of the current energy input into many small-scale enterprises is negligible. The case studies illustrate that any intervention into or impact on current expenditure on domestic energy use, particularly in small and micro-enterprises, is likely to upset the delicate balance between income, expenditure and turnover and render the enterprise no longer viable. The studies documented in this report signal the importance of addressing the energy component of urban poverty holistically. That is, they signal the need to address energy in the context of all other inputs needed to sustain an urban livelihood, and not necessarily to promote the transition from one energy carrier to a 'higher grade' one, unless this can be done without disturbing the current equilibrium.

2 South Africa: the context

According to the 1996 Census figures, the population of South Africa is estimated to be 40,5 million. The Poverty and Inequality Report (May 1998) which reviewed the extent and nature of poverty and inequality in South Africa maintains that, in per capita terms, South Africa is an upper-middle-income country, but most South African households experience outright poverty and vulnerability to being poor. In terms of racial classification, the majority of the population is African – 77%, while the rest is made up by Whites: 11%, Coloureds[1]: 9% and Indians: 3%. Owing to the legacy of apartheid, the majority of the African population still experience the worst conditions of poverty and deprivation (*Cape Times* 21 October 1998).

It has been said that South Africa is two worlds in one country. One world is relatively industrialised with sophisticated communications and information technology systems and high standards of living. This world is inhabited primarily by the white and a small but growing number of black (including Africans, Coloureds and Indians) people emerging as middle class. The other half of South Africa, which is historically black, inhabits a different world of unemployment, poor housing and few services or facilities.

This unequal distribution of income and wealth, which is typical of developing countries (Eberhard & van Horen 1995) is starkly revealed by the income figures: only 11% of the population earn over R4 500 a month, 62% of South Africans earn less than R1 500 a month, 25% earn less than R500 a month and a third of the potentially economically active population is unemployed.

Unemployment rates are highest among Africans, women, youth, those in rural areas, and those with no previous work experience (May 1998). These statistics become real when options for energy service are considered. One in five South African adults have received no formal education at all, while a mere handful (6%) has completed any tertiary education. Again, the census data indicates that African women are the hardest hit on most levels, not only do they experience the highest rate of unemployment, but they also constitute the largest group of unskilled workers. This lack of education has to be remembered in the design of technology such as pre-payment meters.

The census data not only highlighted the gulf between the small group of 'haves' and 'have-nots', it also showed the enormous imbalance in quality of life between the country's nine provinces. The population density varies between the provinces: KwaZulu-Natal has the highest density, the Northern Cape the lowest. The largest concentrations of population are in the biggest cities: Johannesburg (in Gauteng), Durban (in KwaZulu-Natal), and Cape Town (in the Western Cape) which all incorporate major black suburbs (townships) as do Bloemfontein (in the Free State), and East London and Port Elizabeth (in the Eastern Cape). May (1998) suggests that the incidence, depth, and severity of poverty are highest in South Africa's small towns, followed by secondary cities, and is lowest in the country's four metropolitan areas. This is important consideration for resource allocation such as the national electricity connections budget.

2.1 Urbanisation: challenges for low-cost electrification

The trend towards urbanisation has been more rapid in South Africa than in the rest of Africa. The majority of the South African population (about 57% according to Eskom 1996) has been urbanised for the past decade. The demise of apartheid has removed the last discriminatory controls on access to the cities and levels of urbanisation are increasing despite prevailing conditions of unemployment, poverty and deprivation in urban areas. According to Davis & Steyn (1998:108), while the average population growth rate in the country is 2% a year, the growth in the number of urban dwellers is higher as the process of urbanisation continues. The problems of poverty, ranging from lack of access to proper housing, education, health, sanitation, water and energy are becoming increasingly severe. May (1998) cautions that a huge and persistent backlog in infrastructure, coupled with increasing urbanisation, indicates a relocation of rural poverty into urban areas.

Since 1994 the new democratic government of national unity, led by the African National Congress, has instituted programmes to try and address some of the historic inequities but much has still to be

[1] This was an apartheid classification for people of mixed decent.

done. A lack of capacity at all levels and a lack of funds constrain development. Service provision, including urban energy provision and electrification will remain an important challenge in years to come, not only to overcome the current backlog, but also to meet the increase in urban population.

3 An overview of the South African energy sector

South Africa is a country with well-developed infrastructure similar to that of industrialised countries. The energy supply system in particular is well developed in terms of the production and supply of energy to industry, commerce and middle-class households. The South African energy system is dominated by the use of coal which accounts for more than 70% of primary energy demand, and nearly a quarter of final energy consumption. Substantial coal reserves enable the production of among the cheapest electricity in the world, although it should be noted that factors such as environmental costs and other externalities are not accounted for in the price (Trollip 1996). The electricity industry includes sophisticated nuclear technology and a well-developed national grid. National electricity utility Eskom produced 52% of all electricity generated on the African continent in 1994 yet only about 40% of South African homes had access to this energy source. Eskom has substantial excess generating capacity which has been put to use in the national accelerated electrification programme so that by 1998 50% of the population (urban and rural) had access to electricity.

South Africa produces its own oil (albeit at high cost), has the potential to tap into the gas fields of Mozambique and Namibia (or produce its own biogas), and has adequate biomass resources (albeit in places inaccessible to people). Commerce, industry (including mining) and transport account for 80% of energy consumption, and the domestic sector 20%:

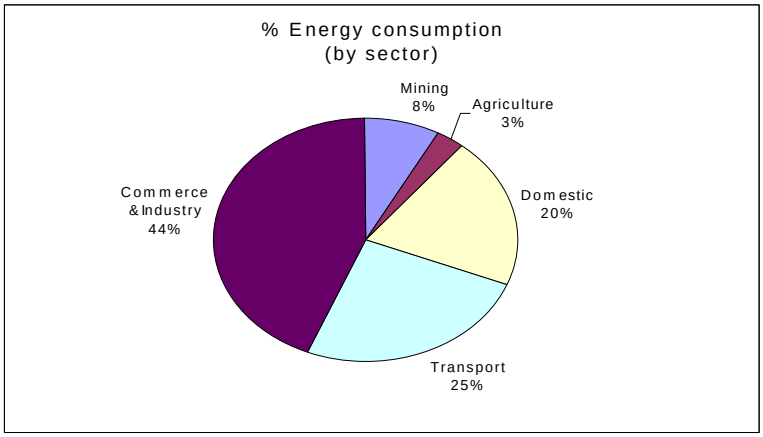


Figure 1: Net energy consumption in South Africa in 1993 by sector
Source: Department of Mineral and Energy Affairs quoted in Trollip 1996

3.1 Energy use patterns within the household sector

In describing the household or domestic sector, Williams (1994:4) said

> (This sector) has energy demand and supply characteristics which make it particularly difficult to assess and analyse. It consists of a multitude of individual users who fall into a wide variety of energy use categories. There is a tremendous diversity in the availability and costs of energy supplies; in the levels of consumption and mixes of fuels employed; in the desired services such as cooking, water heating, space heating and lighting; and in the technologies and behavioural modes.

The important point is that household energy use patterns vary considerably and are influenced by a number of factors including geographical location of dwellings, household income, dwelling type, availability and affordability of energy sources and appliances, habit, gender and power relations linked to household structure, and individual choices or preferences. The variety of energy carriers used within the low-income household sector include biomass, candles, illuminating paraffin, liquefied petroleum gas (commonly referred to as LPG or gas), dry cell and car batteries, electricity and coal. These energy sources offer different services in varying degrees of convenience and safety. The figure below illustrates the contribution of different energy sources to household energy consumption.

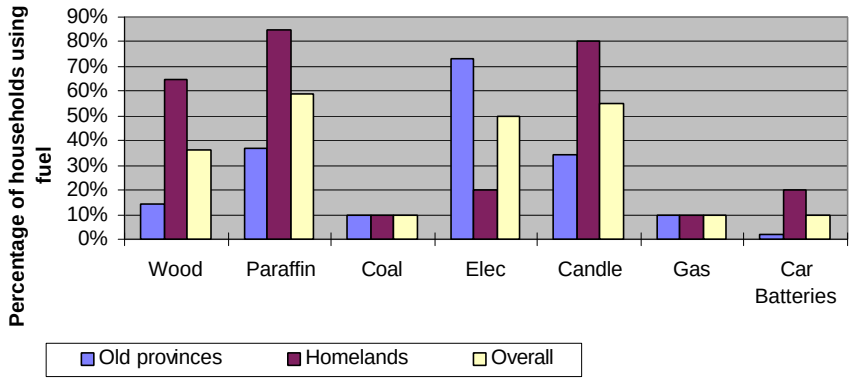


Figure 2: Percentage of households using fuels in areas of the former provinces and homelands and the overall situation
Source: SALDRU 1994 data analysis quoted in Afrane-Okese (1998:71)

Of particular significance here is the use of multiple fuels which is prevalent in many low income households in South Africa. While wealthier households are reliant on electricity, many low-income households, if they have access to electricity, use it in conjunction with other less convenient energy sources such as illuminating paraffin, wood, candles, and dry cell and car batteries. Clearly most of the surveyed households used a combination of energy sources. Most of these energy sources have been commercialised, a situation which impacts heavily on the urban poor as they are forced to spend a proportion of their income on energy.

Another important observation from this figure pertains to the variations in energy use patterns between the former homelands and old provinces of South Africa. For instance, while almost 70% of households in the former provinces (metropolitan areas) use electricity, only 20% of households in the former black homelands had access to this energy source. It is also worth noting that most households in the former homelands are rural, while in the old provinces a majority of households are urban. These are important considerations when addressing social equity issues and prioritising resource allocation.

Another notable observation is that coal, gas and car batteries seem to be less popular in their overall contribution to domestic energy consumption. However, these energy sources play a critical role in the livelihood strategies of households who do not have access or cannot afford other forms of energy (Afrane-Okese 1998). With respect to coal, studies have shown that it is mainly used in Gauteng province where it is readily available, whereas LPG use is more common in the Western Cape households which are far from the coal mines (Mammon 1995). Car batteries are used by a number of non-electrified households to power entertainment appliances – mainly television sets and hi-fis. The following case study illustrates an example of multiple fuel use in low-income households. It also serves to introduce the main issues discussed in this report which affect energy use within low-income households.

3.1.1 Case study : Multiple fuel use as a fuel saving strategy

Nothembile aged 53 lives with her spouse Livingstone who lost his job in February 1995 due to illness. They stay with their three children and two grand children. At present there is no one bringing income into the household and they are waiting for Livingstone's delayed Unemployment Insurance Fund (UIF) money to arrive. Nothembile has decided to sell snacks, icelicks and chickens' feet to schoolchildren but this is not a reliable source of income. She uses a refrigerator to cool ice licks and for cooking chicken feet she uses paraffin or LPGas.

Nothembile says that since her spouse lost his job they have stopped using electricity for cooking and only use it for lighting, refrigeration and television: 'we try to reduce costs, we cannot afford to use electricity for everything. Therefore we use gas for cooking but it is expensive, like electricity we cannot use only gas, so sometimes we use paraffin as well'.

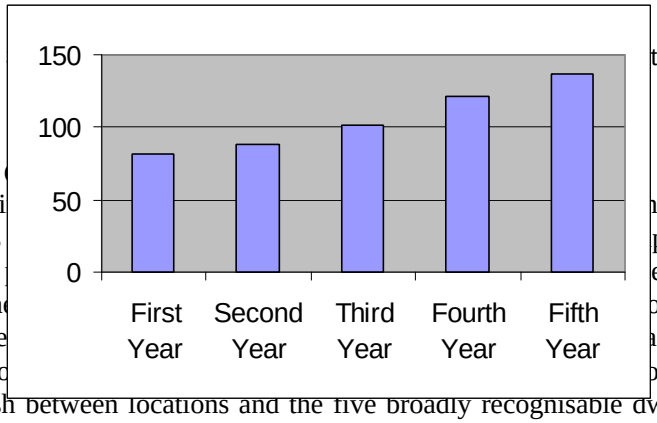
Fuel saving strategies employed in this household changed twice during the survey. Firstly, the household used gas for cooking some foods and paraffin for other staple foods that take a long time to cook such as samp. However, this also changed as Nothembile decided that everything should start on a paraffin stove, to boil before it is transferred to a gas stove to simmer. This is particularly done on Sundays when they cook different foods. However, when cooking samp and tripe only paraffin is used. In winter, this is done on a paraffin heater so that it can serve two purposes at the same time: space heating and cooking.

They complained about the poor quality of the materials used to build houses in Khayelitsha. The walls in the main bedroom were damp and they had to put a ceiling board against the wall to protect themselves at bedtime. She and her husband complained that their children always suffered from flu because of the damp, and their clothes had mould. For these reasons they preferred to keep the heater in the bedroom (Mehlwana & Qase 1996).

3.1.2 Electricity as a determinant of energy poverty

Several studies have suggested that the lack of access to electricity is the primary defining characteristic of poor households in relation to energy (Eberhard & van Horen 1995, Trollip 1996). It is true that almost every household aspires to having electricity and that those who can afford to, use it for all domestic purposes. Electricity is a desirable energy source because of its versatility and convenience. Unlike any of the other energy carriers, electricity use is effortless: people do not have to travel long distances, worry about fire and poisoning, or carry heavy loads.

At the point of use electricity does not pollute the environment, instead it contributes to the improvement of the quality of life of the users. At the same time not all households have, or are likely to get electricity connections in short to medium term, and many of those which have been recently electrified cannot afford to buy appliances or pay for its services

Figure 

tion

3.1.3 Electricity,

As with many developi find shelter in run-down central business phery of the cities. Although this is a new ervices in the CBDs have not been researche not maintain these buildings and they are s services, such as running water, sanitatio gnised first, so it is important to distinguish between locations and the five broadly recognisable dwelling types which differ in terms of social and legal status. These dwelling types include, formal dwellings, backyard dwellings (found in formal dwelling areas), informal planned shacks (site and service schemes), informal unplanned shacks (urban slums) and hostels.

Formal dwellings, built in designated 'black' areas known as townships, have had electricity for several decades and were billed on the old metering systems. Many of these households in specific, organised areas, actively engaged in campaigns of non-payment for services in protest against the

apartheid government, others simply neglected to pay their electricity bills for reasons partly explained in case study 1. Structures built in the back yards of township houses originally accommodated growing families but are now rented out and are much in demand. Tenants have little security and services are supplied through the owner. There are no plans at present to extend independent services to these dwellings because they have no legal status. Informal planned shacks are those built legally on tenured land and supplied with basic services. These are the main focus of the current electrification drive in urban areas. Informal unplanned shacks are those erected without permission and not legally recognised although over time and negotiations some may become so. These areas, which are often vast and house thousands of people, do not qualify for electrification because there is no secured tenure.

Hostels are another remnant from the apartheid era. They were built as single-sex institutions to accommodate (male) African migrant workers for the duration of their stay in South Africa's formerly 'white' urban areas. The hostels originate from the mining industry in the 19th century although hostel accommodation reached a peak during the 'grand apartheid' years of the 1960s and 70s. There are three kinds of hostels: private compounds attached to specific places of work; public hostels owned by local or provincial authorities which offer accommodation to workers from a range of industries; and 'grey sector' hostels, where the structure is owned by private companies and the land by the local authority (Thurman 1997). Turning the hostels from dormitories into family accommodation has been a challenge to all concerned. Hostels have been the sites for many pilot projects including solar water heating systems as described in case study 3.

Energy use patterns and needs vary between dwelling types, although this statement does not claim homogeneity within dwelling types, as circumstances within households may differ. Households with electricity connections have a wider variety of choice than those without and proximity to supply, for example transport routes for LPG or natural vegetation for wood collection also influence the combination of fuels used.

What follows is three sets of case studies. The first set highlights the strategies adopted around low-cost electrification of poor urban communities. As apparent from the overview of the current status of energy poverty in South Africa, only 70% of urban households are electrified and many low-income households which have connections cannot afford to use electricity alone. For this reason, the second set of case studies documents energy efficiency initiatives that aim to reduce household energy expenditure. Such initiatives are also important in testing more sustainable solutions to the problems of energy provision in urban areas. Given this, acceptability of these initiatives to the communities is important and is therefore assessed. The third set of case studies shifts the focus to examine energy use for small-scale enterprises, including survivalist enterprises.

4 Low-cost electrification

4.1 The national households electrification programme

The accelerated National Household Electrification Programme, a strategy aimed at improving equitable access to energy services in South Africa, is the main theme in this section. Eskom launched this ambitious household electrification programme in 1991, and it was endorsed by the government in 1994. The programme targets low-income households in both urban and rural areas. While the emphasis is on grid electricity in urban areas, rural electrification projects explore various options such as grid and off-grid supplies.

Eskom and various municipal distributors are responsible for the implementation of the electrification programme. In terms of the allocation of responsibilities, Eskom, is mainly responsible for bulk distribution in rural areas while various municipalities are responsible for urban electrification in their designated areas. Eskom generates and distributes electricity to municipalities which then sell it to consumers. According to Davis & Steyn (1998:115) an incentive was introduced in the early 1990s to encourage municipal distributors to undertake electrification projects. Eskom refunded municipalities R400 of the cost of each new connection. Bulk discounts were also available to municipal distributors on the basis of their electrification programmes.

The electrification programme is target driven, and the main objective is to facilitate the government policy of providing electricity to 80% of South African households by 2012 (Davis & Steyn 1998:110). Annual electrification targets were set at 450 000 new connections. Eskom in particular had no problems in meeting these targets.

4.2 Costs of electrification and the strategies used to minimise them

The capital costs of connecting dwellings to the grid vary between provinces and as well as between rural and urban dwellings. This is illustrated in Table 1.

Province	*Urban costs per connection (R)*	*Rural costs per connection*	*Average costs (R)*	*Total costs (Rm)*	*Total (%)*
KwaZulu/Natal	3 123	4 390	3 716	331	23
Northern Cape	2 403	4 439	3 718	14	1
North West	3 141	3 737	3 600	144	10
Eastern Cape	2 699	3 894	3 539	331	23
Free State	2 099	5 859	3 421	87	6
Northern Province	2 923	3 232	3 212	245	17
Western Cape	2 879	1 423	3 830	58	4
Gauteng	2 607	N/A	2 607	130	9
Mpumalanga	1 967	2 690	2 507	100	7
Average	2 708	3 623	3 245	1 440	100

Table 1: Capital costs of electrification per connection in 1996
Source: National Electricity Regulator quoted in Davis & Steyn (1998:113)

According to Davis & Steyn (1998:112), in 1996 the average capital cost of household electrification was R3 250 per connection when using the weighted average between rural and urban electrification. At this point we focus on the supply strategies used to minimise the costs of electrifying poor communities. These strategies include:

- the use of pre-payment meter technology and ready-boards;
- the use of load limiters, especially in rural households;
- looped service connections, meaning that several customers feed from the same service cable (Smith 1995:37);

- mass electrification projects which maximise economies of scale.

This report mainly explores the use of pre-payment meter technology and ready boards in low-income urban households.

4.3 Prepayment metering technology

Before the introduction of pre-payment meter technology, distributors used credit meters where customers were billed monthly for their consumption. In poor communities in particular, many people accumulated debt, which resulted in loss of revenue to the utility. The pre-payment meter technology was designed mainly to overcome this problem, but it turned out that this technology suited many customers too (James 1997).

4.4 The pre-payment meter and ready-board package

Eskom introduced a pre-payment meter technology and in newly electrified poor urban households. This comes as a package including the meter and a ready-board. The meter reflects the amount of electricity credit that a consumer has. Electricity sales are made either through the purchase of a magnetic strip card or the issuing of a unique number sequence. Every meter is individually coded so each card or number can be used in only one meter (Davis & Steyn 1998:117). As the term implies, consumers are required to purchase electricity in advance, and their purchases are linked to the supplier, making it easier for suppliers to do individual audit of consumer accounts. The customer has to swipe the magnetic card into the meter, or punch the unique numbers into the meter to record the amount of electric units credited.

The ready-board provides the consumer with plug points (usually three) to connect appliances. In other words, the ready-board comes as a substitute for conventional house wiring, and is another strategy to minimise costs. Smith (1995:40) suggests that ready-boards provide consumer protection and facilities for connecting cable/conduit. In some cases a light bulb is also provided.

4.5 Advantages and opportunities presented by pre-payment meter technology

4.5.1 Customer point of view

Firstly, the fact that electricity purchases (both swipe card and digital recording) are individualised means that they are not transferable or open to fraudulent use by other people. Many customers value this sense of security, as noted by Africa et al (1997).

The second advantage is that energy expenditure patterns are not different to poor people's experiences and behavioural patterns when using illuminating paraffin. Because many people have unreliable incomes and the cash flow is not consistent, paraffin purchases accommodate these cash flow patterns – people can buy it in various quantities at different prices. This means that in times when the cash flow is limited, people can buy small quantities of illuminating paraffin at prices they can afford. (A litre costs about R2.50). Similarly, the pre-payment meter technology allows people to buy electricity in small denominations and although the smallest is R5, double the price of paraffin, it is still manageable for many. The only problem is that this amount of electricity can only be used for less energy-intensive activities such as lighting and media. For energy intensive activities, people have to look at other alternative energy sources, when the cash flow is limited.

The third advantage is that people are able to monitor their own electricity consumption and this leads to an informed clientele. For instance, from using pre-payment meters people have been able to determine which appliances consume more electricity, and to alter their behavioural patterns accordingly. For example, in a three- year longitudinal study conducted in the Western Cape titled 'Social determinants of energy use in low-income urban households', it was found that when people realised how much electricity bar heaters used, they changed to paraffin heaters (Mehlwana & Qase 1998). See case study 1a as an example.

4.5.2 Case study 1a: Using pre-payment meters leads to informed users

Lungiswa, a 25 year old student living in Khayelitsha near Cape Town, is the only woman in a five-member household. She is responsible for buying most of the household appliances and contributes to fuel purchases using her bursary money. Some time ago she bought a one bar electric heater. She says that she only uses it when it is very cold and only for a short time. If the units in the meter are very low (equal to about R5 worth of electricity) then they do not use a heater at all, even if it is cold, turning to a paraffin Primus stove for warmth. Subsequently, in 1996 they bought a paraffin heater for space heating because it is cheaper to run than an electric heater, (Mehlwana & Qase 1996:26)

Paraffin heaters are preferred because they are cheaper to run and they can be used for multiple purposes – heating water and cooking/baking at the same time as they are used for space heating. It must be emphasised that this important learning for householders came as a result of using pre-payment meters – from the range of appliances that people have, they are able to identify which appliances are cheaper to run on electricity. In contrast, case study 1b reflects on the experiences of customers who are still on a billing system. While customers on the pre-payment meter system can control their energy consumption and expenditure, customers on the billing system are unable to do so because of lack of information.

4.5.3 Case study 1b: A bewildered electricity consumer on the billing system

Sibusiso Khoza, a man of 55, runs a spaza shop from his house in Mzimhlophe, in Gauteng province. He had his coal stove removed 20 years ago and replaced it with an enormous electric cooker, which his wife has on all day baking tray upon tray of cookies to sell. Until recently, he used to leave an electric heater on all night in winter and sleep only with a sheet, but now 'economises' by leaving a pot of water on the boil on one of the hotplates as a form of space heating. Yet, he is angry and bewildered at the size of his electricity arrears, and his current monthly bill. 'You know', he says, 'I haven't even got some kind of machine that pulls a lot of electricity such as an electric saw or a lawnmower, I've only got these few domestic things,' (White et al 1997:422)

People who are currently on the billing system like Mr Khoza, but have huge arrears threatening their current supply, have the opportunity to switch to pre-payment meters rather than be disconnected indefinitely.

4.5.4 Utility and government point of view

The advantages of pre-payment meters from the utility point of view were summarised by Patricia Kreiner, Cape Town Mayor in 1994. She said pre-paid Econometers were ideal for providing electricity to less formal settlements: 'Users buy their electricity from the nearest vending site, thus paying for their power before they use it. This eliminates the need for meter reading and for accounts'. Regarding the important role played by Econometers in reducing the municipality's electricity arrears of R60 million, she said, 'Users who are in arrears pay a certain portion of their advance electricity purchase towards the outstanding amount. In this way, they can pay back the money they owe at a pace they can afford, and they can be reconnected while still in arrears. In June, with 20 000 Econometers installed, we recovered R90 000.'

The challenge of electrifying informal urban settlements became possible and much cheaper through using pre-payment meter technology. Electrification of these settlements has increased access to electricity in urban areas close to 80% and, with the exception of Mpumalanga, all nine provinces have urban access levels greater than 70% (Davis and Steyn 1998:108).

Pre-payment meter technology is developed locally, which is perhaps another critical advantage for South Africa (Electrification and Prepayment Electricity 1996).

4.6 Constraints of using pre-payment meters

The use of pre-payment meters has some problems. Firstly, pre-payment meters can be a major inconvenience to customers. Customers who are supplied with pre-payment meters require access to vending stations for almost 24 hours. This is necessary because sometimes electricity units run out

without a warning. If the vending station is closed, it means that people have to have some back-up system in the form of other energy sources or spare cards to use when needed. The latter may be unwise if a person wants to conserve energy in a household where there are many occupants and too many credits can lead to inefficient usage.

Secondly, for elderly and less educated people, punching in the long digits into the meter is an awkward experience. In some cases people have complained about the placement of the meter – for instance if it is placed too high against the wall it becomes difficult to see the band which reflects the electricity units.

Another constraint relates to the use of the ready-board, a substitute for conventional house wiring. Usually the ready-board meter package comes with a light bulb. In poor households this becomes the only electric light while in other rooms people continue to use illuminating paraffin and candles. This is simply because they cannot afford to extend wiring to the whole house. This is an unfortunate situation since electricity provides a superior and much cheaper service for this particular end use (Clark 1997). In contrast, illuminating paraffin and candles have health and safety hazards.

4.6.1 Case study 1c: Multiple energy sources for lighting due to the lack of house wiring

Codelia is a 58-year old domestic worker working for R500 a month at a surgery in Vasco. She stays with her eight children and grand children in a her two-roomed house in Khayelitsha. For cooking she usually uses gas, although paraffin is cheaper. She does not like using paraffin because the smoke has a bad effect on her chest problems. However she is forced to use it to reduce costs when she prepares samp because this particular meal takes such a long time to cook.

In her house there is no proper wiring which means the people have to switch the lights on and off from the ready-board in the kitchen. To avoid this inconvenience she uses candles at bedtime, and electricity only for lighting in the kitchen. She also uses electricity to boil water and iron since she cannot afford to buy other electrical appliances (Mehlwana & Qase 1996:21).

In shack settlements, however, the use of candles is not advisable since candles together with paraffin appliances have caused accidental fires, destroying people's property and sometimes resulting in loss of life.

Owing to lack of house wiring, people are forced to use extension cords and multiple adapters to connect their appliances. This is hazardous because it can cause overloading.

From the utility perspective, it has become apparent that pre-payment meters can also be by-passed, as households continue to temper with the meter in certain parts of the country.

The case study below summarises the main issues that pertain to the use of electricity in low-income households. These issues are:

- unreliable incomes which make it difficult for poor households to plan ahead for their energy-related expenditure;
- the need to improve access to electrical appliances;
- people's desire to use electricity. Many of them buy second-hand appliances which are more affordable than new ones;
- the problems relating to the use of 'street electricians' to do house wiring, as seen in this case study, can be costly and dangerous;
- the common experience that electricity is expensive when used for thermal applications. From the perspective of poor communities, using electricity for space heating serves only one purpose – coal and paraffin appliances can be used for space heating and/ or cooking, baking or water heating simultaneously. This reduces costs.

4.6.2 Case study 1d: A summary of the barriers faced by aspirant electricity consumers in newly electrified homes[2]

Sizeka is a single woman aged 32. She has two children who live with her parents in the Eastern Cape. She lives alone in a three-roomed shack in Site B, Khayelitsha and works part-time at a chain store in Site B, less than 15 minutes walk from her home. Although she has worked there for 18 months, she is still a casual employee, meaning that her job is not secure. She receives about R800 a month. Her shack, together with others in the settlement, was electrified in December 1994. The ready-board is installed in the kitchen and she has managed to wire her shack so lights have been fitted in all the rooms.

Due to the uncertainty of her job she buys second-hand goods, both furniture and appliances. The option of buying things on hire purchase (HP) is too risky. She says 'I do not want to buy something on HP and then the next thing I lose my job. If I lose my job I will not be able to pay my debt and whatever I have bought will be repossessed. If this happens, I will lose all the money that I have already invested'.

Among the things that she bought second-hand are electrical appliances: an electric kettle, a stove, a two-bar heater and an electric iron. The only appliances she bought brand new are her paraffin Primus stove and her black and white television set.

She bought her four-plate electric stove for R250. She paid it over two months via the lay-bye system.[3] When she bought this stove she had to hire someone to modify it for her in order to fit a standard three-pin plug. Originally the stove used to be connected to a wall plug, but there is no wall plug in her shack. She paid R70 for this work. While all the plates were fully functional, her oven was not functioning. When she tried to use the oven a week after the stove was connected, it nearly caused an explosion, releasing clouds of smoke. She suspected that it was not connected properly so she decided to report the matter to the man who connected the stove for her. Unfortunately he did not want to listen to her since she took a long time before coming back to him with her complaint. (The way her four-plate stove was modified in order to fit into the ready-board was very dangerous – two of the wires were sealed with a non-insulating brown tape and only the live wire was connected to the three pin-plug).

She changed her stove plates from the solid to the spiral type as she believes that the former consumes too much electricity. At first, she changed two plates, and was in the process of saving money so that she could change the remaining two. She used her stove like this (two spiral plates and two solid plates) for almost a year but now the stove is broken. Instead of repairing it again, she has finally resorted to using a hotplate which she bought at a bargain price from her workplace

She buys electricity (in Site B households use digital recording system) for between R10 and R15 a month. She believes that her stove does not consume a large amount of electricity but the electric bar heater does. When she uses the heater for space heating, she makes sure she does not use it for a long time and also that it is in her bedroom which is smaller than other rooms. One of the reasons her heater consumes so much electricity is that she uses both bars. When she bought the heater it was already broken so she is unable to adjust it. In order to save electricity, she prefers to use a Primus stove for space heating. In addition she says 'having a Primus stove and paraffin in winter is good because we have frequent power failures, so it helps. In such cases I also use paraffin for lighting'.

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2 Adapted from Qase, N. 1997. Is it possible to improve people's quality of life through the current electrification programme? Paper presented at the African Youth Energy Symposium. Johannesburg, South Africa. September 29-4 October 1997.

3 A lay-bye is another form of purchasing goods in which the buyer puts a certain amount of money (usually 10 per cent of the normal price) as a deposit, and thereafter pays the remaining amount over a minimum period of three months. The distinction between this method and HP is that there is no additional charge. Instead, the purchaser receives goods once they have been paid for in full.

4.7 General constraints associated with the electrification of poor communities

Having electricity in the house provides people with varying opportunities depending on whether or not they have the appliances necessary to use it. Research conducted in many poor communities shows that many people cannot afford to buy electrical appliances (Mehlwana & Qase 1996, White et al 1997). Under such circumstances people have to use other energy sources with different appliance combinations or purchase second-hand appliances as was done in case study 1d. Buying second-hand is risky for people who are ignorant about electrical appliances, and unless informed, they may end up with inefficient appliances.

Inadequate access to appliances affects not only the consumption of electricity, but also the objective of improving the quality of life of poor communities. In addition, low consumption of electricity may affect the long-term financial viability of electrification programmes. In order to address this problem, some municipalities, such as the one in Durban, provide households with a set of basic appliances including two-plate stoves as part of the electrification package.

A second constraint is the lack of information – people who are introduced to electricity for the first time need to be given information about how to use it efficiently. For instance, in a study conducted in Bapong, a township in the North West Province, Golding (1993) found that newly electrified households spent more money on energy because they engaged in energy-using activities more often than when they were using inconvenient fuels such as coal. On average these households made tea or coffee 2,3 times a day while those without electricity averaged only 1,3 times (quoted in White et al 1997:415).

Thirdly, as case study 1d indicates, supply of electricity particularly in low-income areas is unreliable.

5 Energy efficiency initiatives

In addition to the fact that many low-income households cannot afford electrical appliances such as hot water geysers and heaters, using electricity for water heating and space heating increases energy expenditure. This increases the proportion of income poor households spend on energy, while stretching household budgets to their limits. Energy efficiency initiatives can therefore benefit poor communities by reducing the amount of money spent on energy. Regarding this, various initiatives have been tried such as energy efficient lighting, the use of solar water heaters, and thermal efficient design of dwellings. However, this section of the report only focuses on case studies addressing space heating and water heating requirements.
Secondly, these initiatives can benefit poor communities in terms of reducing health and safety risks. More than often, the main energy sources used for thermal applications in poor communities are coal, illuminating paraffin and woodfuel, because they cost less in financial terms than electricity. These energy sources are all associated with indoor and outdoor pollution. There are health risks related to burning these fuels inside dwellings such as respiratory illnesses, and cardiac arrest. In addition, the use of paraffin is associated with poisoning in children and shack fires, which in some cases may result in loss of life (van Horen et al 1993:632-633).

As van Horen et al (1993:623) concluded, the above arguments point to the fact that efficiency measures should form part of the electrification initiative to ameliorate environmental costs. These initiatives hold the potential to improve the quality of life of poor urban communities.

For the utility, the benefit is that energy efficiency measures can reduce peak load. Soaring peak loads can be very costly to the economy in terms of system maintenance, let alone the cost of building more power plants.

Below are three case studies illustrating in more detail the energy efficiency initiatives that have been undertaken in different communities. The first two case studies look at the introduction of solar technology for water heating in Ivory Park and Lwandle hostels. The third explores the passive solar design technique used in the construction of houses in Kutlwanong, Kimberley. All these case studies focus on pilot projects aimed at reducing the household expenditure on water heating and space heating. Their successes and failures will be examined.

5.1 Case study 2: Solar water heaters in Ivory Park[4]

Ivory Park is a low-income settlement located in Midrand in the Gauteng province. This project was part of the UNDP and SADC Energy sector programme aimed at promoting renewable energy and energy efficiency technologies in the SADC region. The programme is called FINESSE – Financing Energy Services for Small-Scale Energy Users. Its pilot phase covered South Africa, Lesotho and Zimbabwe, with the intention of extending it to the rest of the SADC region.

5.1.1 Objectives

The objective of the project on solar water heaters (SWHs) was mainly to increase the use of SWHs in low-income households. The project targeted 40 000 new houses planned for Ivory Park and other low-income settlements in the Midrand local council area. According to the project report, the Midrand local council has a strong enabling environmental policy, which manifests in, among other things, the promotion of low-energy using dwellings and the creation of local employment opportunities during housing delivery.

This project addresses people's needs to heat water for various purposes. It has been suggested that low-income households earning less than R500 per person per month in urban areas of South Africa spend an average of R10 per person per month to heat water. At the same time it is an important innovation at a time when few newly constructed low-income houses are being provided with electric hot water storage facilities.

[4] Adapted from the Energy & Development Group 1997. Finesse Draft Final Report: South Africa Country Study. Report prepared for the Energy Directorate: Department of Minerals and Energy, South Africa.

5.1.2 Potential benefits

The potential benefits of the project to the users are in terms of cost savings because it is more expensive to install an electric geyser and because electric geysers are more expensive to run than SWHs.

5.1.3 Constraints

A limiting criteria for this project is that households must have access to pressurised water in the dwelling which is not a problem in new RDP housing.

5.1.4 Maintenance quality and capacity building

The supplier of the SWHs will be requested to train local members of the client communities in front-line fault detection and minor repair work. Each year for 15 years a one month training course on the technical and financial aspects of SWH maintenance will be provided by the implementer of the project.

5.1.5 Successes

The project claims the following outputs:

- establishment of a market profile and indication of receptiveness to SWH systems of households in Ivory Park;
- the elaboration of a mechanism to provide an innovative and flexible financing mechanism for small loans into a high risk market;
- the approval of a budget for a small pilot implementation project in Ivory Park to confirm the operational implications of SWH business activities, including retail financing;
- the development of a medium sized project brief to GEF for a range of parallel activities to enhance the market environment for widespread implementation of SWH systems (Energy & Development Group 1998:E/S5-6).

5.1.6 Failures of the project

The project was not sufficiently implemented for various reasons. Business owners were not identified or confirmed and the relationships required for sustainable business could not be established. Other reasons include the gradual withdrawal of MidDev, identified as the main business owner, due to internal reprioritisation and the slower-than-anticipated delivery of houses. The complexity and high risk associated with small unsecured commercial loans to low-income households and thus the reluctance of financial stakeholders to establish financing mechanisms for this market, defeating the project plans. A last reason is the lack of clear government policy to encourage the adoption of SWH systems and thermal efficiency in housing. The recently released White Paper however, now establishes a policy framework within which these technologies are endorsed, but it will take some time before this endorsement is communicated to all stakeholders (Energy and Development Group 1998:E/S-5).

5.2 Case study 3: Alternative water heating in Lwandle hostels, Western Cape

5.2.1 Background and scope of the project

Lwandle is a hostel community with a population of approximately 5 000 people that is undergoing an upgrade which includes improved privacy for inhabitants, water-borne sewerage and an affordable hot water service in the existing 341 showers. Lwandle Hostels to Homes project is a unique project in the Western Cape. Failures and successes of its implementation are likely to influence workers' hostel upgrades locally and throughout South Africa. Success will contribute to local community and other hostel dwellers in providing an improved quality of life in the future. The use of non-electrical water heating also has the potential of reducing electricity and other services arrears.

5.2.2 Community participation

The Lwandle project has one of its goals the provision of affordable hot water service. Information on how this goal could be achieved was shared with the community in November 1997. The Lwandle community asked Energy Transformations CC to conduct research and advise it on the costs of hot water supply. Based on the presentation of the research findings, the community through the Lwandle Negotiating Group (LNG) took a decision to use solar water heaters to provide their hot water energy service for 341 showers. The LNG asked consultants to facilitate this process by designing activities that could be implemented to provide an affordable hot water service.

5.2.3 Opportunities

The project involves the provision of hot water for the 36 showers in the communal ablution blocks. The 36 showers are spread amongst nine ablution blocks scattered around the hostels. The semi-communal ablution facilities do not have a hot water supply yet (with the exception of a few pilot solar water heaters) and some of the communal ones have paraffin heaters installed.

The provision of a hot water service was achieved through the installation of paraffin-in-line heaters, with the possibility of a later addition of solar water heaters should sufficient funds be raised. Paraffin heaters are used in some of the communal ablution blocks.

The use of non-electrical energy sources can assist the electricity suppliers in avoiding costs associated with peak electrical demand. Less electricity consumption during this period will have a positive impact on Eskom's supply infrastructure, thus contributing to the efforts of both Helderberg Municipality and Eskom to sustain lower-priced electricity. This project could therefore assist Eskom with meeting its national demand side management (DSM) objectives.

In addition, the project provides a platform for Eskom to serve its interests in assisting communities to improve energy service affordability and to reduce the potential impacts of the accrual of arrears. Interest in enhancing local technical capacity with the associated employment potential can similarly be realised.

This project also presents an opportunity to set up sustainable small business around the provision of affordable hot water service in Lwandle's communal showers. This will create jobs for the community, and contribute to skills development through hands-on experience for people who will assist in setting up the project.

5.2.4 Project funding

The LNG insisted on pay-as you-use metering system, which they suggested would reduce potential abuse of hot-water service. The LNG also asked Energy Transformations to find the necessary resources to facilitate access to the water heating service. Energy Transformations, understanding the interest of Eskom in demand side management and residential water heating, proposed that Eskom play a participating role in the project. Eskom offered to cover the cost of non-electrical back-up to the solar water heaters and the monitoring of the project. These contributions are added to the community's offer of investing R800 000 in the project. The Helderberg Council – owner of the hostels, is currently considering a loan request for R2 million to cover the full cost of the project. Further funds could be raised through a proposal pending with the Dutch Government Ministry of Development Co-operation that is considering the project as a pilot joint implementation. Similarly, the Independent Development Trust is considering the possibility of a loan.

5.2.5 Stakeholders

The main stakeholders include: Energy Transformation CC, which is responsible for the outputs of the project proposal, the Lwandle Negotiating Group, the Lwandle Hostels to Homes Project developers and the candidate entrepreneurs who will be managing the communal showers.

5.2.6 Problems

The technology is too costly. The hot water metering and monitoring prototypes will not provide an adequate cost recovery and impression of technical performance. The combinations of technologies being tested for the first time, SWHs , paraffin and thermostatically controlled LPG-in-line water heaters will not be as compatible as they appear theoretically. However, funding has been approved

in principle and the next phase of the project will be implemented as soon as such funds become available.

5.3 Strategies to reduce space heating needs in poor communities

The concept of passive solar design forms the central theme in case study 4. This initiative addresses the space heating requirements in poor communities. The need for space heating arises out of the natural climatic conditions, resulting from geographical location of dwellings. Some provinces are colder in winter than others. Under such weather conditions, it becomes necessary for households to use additional means to heat the houses in order to improve their comfort levels.

In addition, poor communities are often located in poor housing structures, sometimes because of the land on which they are located, but more often because of the quality of the materials used in the construction of dwellings. Since natural weather conditions cannot be changed, passive solar design of dwellings takes account of these conditions through the orientation of the dwelling structure and the use of materials (specifically insulation) to minimise space heating requirements.

5.4 Case study 4: Passive solar design houses in Kutlwanong[5]

5.4.1 Background

Kutlwanong is a small community near the city of Kimberley in the Northern Cape province. Kutlwanong was formally established in 1994. It is a planned informal settlement of approximately 2 300 families (8 000 residents). In 1995, in response to the government's mass housing programme, the community sought to gain access to formal housing. This created an opportunity to experiment with this 'new' concept of passive solar designs.

The Kutlwanong passive solar design houses were the first PEER Africa pilot project in South Africa. PEER Africa, an American civil and environmental engineering firm, was leading the project which became involved as a direct result of the United States-South Africa Binational Commission, an initiative established in 1995.

The United States Department of Energy sent a delegation to South Africa to hold a workshop with local and national energy officials in Kimberley. PEER Africa invited the leaders of Kutlwanong to attend the workshop and to determine whether they would be interested in participating in projects resulting from the discussions. Community leaders were interested in the concept of combining energy efficiency with housing put forward by PEER Africa. At the end of the workshop, a memorandum of understanding to develop and implement this housing concept was signed by the Kutlwanong community, PEER Africa, the Northern Cape Provincial Housing Department, the US Department of Energy, and the South African Department of Minerals and Energy.

5.4.2 Community participation and key stakeholders

The process employed by PEER Africa in Kutlwanong has been a participative one. It worked with the community to develop a framework which meets their development needs. For instance, developers solicited the community's opinion to establish their standard for an acceptable living space, and their preferences for layout and design. Overall, the house style was developed through a process involving frequent community discussions/workshops to explain the concept of passive thermal design. The technical input to the design from a thermal efficiency perspective was provided by PEER Africa in consultation with the US Department of Energy and South African Department of Minerals and Energy. Several architects were employed to assist in evaluating thermal efficiency options.

The US Department of Energy provided a grant to build the demonstration house in Kutlwanong later referred to as the ECO™ house, and PEER Africa provided resources necessary to organise,

[5] Developed by the community of Kutlwanong, PEER Africa, the Energy and Development Research Centre, and the International Institute for Energy Conservation: *The story of Kutlwanong, South Africa*, case study prepared for the United Nations Conference of the Parties III, 6 December 1997.

familiarise and train the community to build the house. The demonstration house was the first of 200 completed. A further 2 100 houses were planned for 1998/1999.

5.4.3 Project funding

First-time owner's housing subsidy funds of R17 500 per house were used to finance the project. In most cases of RDP subsidised housing, a substantial portion of the subsidy amount (about R7 500) is charged by municipality for the capital costs of services. However, in this case, the municipality, after negotiations with the community and developers, agreed to charge only R2 500 from the total subsidy amount, leaving R15 000 for each dwelling for the construction of the top structure. Communities undertook to keep up with their rate payments in order to pay for the system over time. Because a majority of the population in this area is poor, the minimum negotiated rate is R27 a month. In addition people pay for water and electricity which is dependant on the quantity each household uses (Eiland 1998).

The barriers identified in the housing delivery process include the high costs of building materials, country wide delays in the delivery of materials, lack of equipment and machinery, and the high cost of transport of materials and supplies. Also building materials often take up as much as 85% to 90% of the top structure costs. The approach in Kutlwanong was to maximise savings on materials through negotiated bulk purchases and supplies at significantly reduced rates. This became possible through a co-operative agreements between private industry and the government housing programme. This allowed the construction of a home with greater floor space, built with good quality materials, including insulation. Small suppliers were also used in the purchase of materials, and this created a market for them.

5.4.4 Techniques used

The 'Kutlwanong style' house is based on an insulated cavity wall system using a steel frame as the basic structure and polysterene as the primary insulating material. The homes are positioned facing north, and window systems are designed to maximise use of the sun to keep the home warm during cold months. Roof overhangs are used to shade windows during summer. All ECO™ homes have insulated ceilings and are made from products which are easily available in South Africa.

5.4.5 Benefits to the community and the environment

Assuming an energy saving of 60%–80% of the household space heating bill, the ECO™ housing project in Kutlwanong can achieve substantial carbon dioxide reductions. This is based on the fact that 95% of households use paraffin and 5% coal to meet their space heating needs.

The ECO™ house is designed not only to improve thermal performance and reduce energy consumption for space heating, but also to provide outlet vents for noxious fumes from coal stoves. Furthermore, the ECO™ house is constructed of materials that do not readily burn, thereby reducing the risk of fires.

The Kutlwanong housing project became a self-help community development project managed by local people through their community leaders. The project also provided paid employment for residents of Kutlwanong. Over 120 community members, 10% of them women, were employed as builders on the project and they received on-the-job skills training. People were not paid a living wage but at least they received an income, which varied according to the number of people involved and the type of work done. To lay the foundation labourers were paid R600 per house, R1 200 for building the top structure and R575 for making the roof (Eiland 1998).

5.4.6 Lessons from the Kutlwanong project

Although the project has been successful in Kimberley, the replication of its success in other communities with completely different circumstances is yet to be proved. Whilst the size of the community played a vital role, the Kutlwanong community has been unique. Developers worked with a very organised and receptive community. As such, the project became successful through negotiations and co-operation between the different stakeholders involved.

For instance, the project report mentions that communities in the Eastern Cape and Western Cape have asked the Kutlwanong community to share its experiences. Subsequent to this, demonstration houses were built in Gugulethu (2 houses) and Tambo village (four houses) in Cape Town.

However, nothing has happened thus far to replicate the Kutlwanong style housing project. The experience has been very frustrating in Cape Town because of 'too much unnecessary politics. You do not know who to go to because there are too many committees, today you go to this one, the following day its another one' Eiland 1998. Also, it has been difficult to get the municipality to do what the Kimberley municipality did (Eiland 1998).

In Kimberley, local labour was used in building the houses at the beginning, but because this was taking a long time, professional builders were also called in. In phased delivery this has implications for later phases, the longer you take to complete the house, the more difficult it is to keep the costs down. While there are substantial benefits to building energy efficient housing, the process is a lengthy one. Slow delivery conflicts with the target driven RDP housing programme (Simmonds 1998).

USAID, provided finance to pay the architects and other experts who were consulted during the project. This has implications for other projects which may depend entirely on a housing subsidy from the South African government.

A lesson to be learnt from the Kutlwanong project is that building energy efficient houses is a fairly slow process requiring negotiations with different stakeholders. In addition, it is important for developers to learn from each other's experiences. One of the communities near Kutlwanong in Kimberly is demanding that their current contractor be removed so that PEER Africa can come to build their houses (SABC News, 7 February 1999). However, in an country where there is massive backlog in housing delivery it cannot be possible for one developer to meet this demand.

Generally, barriers to implementing energy efficiency technologies as shown in these case studies relate to high entry costs and people's awareness.

6 Energy for small-scale enterprises

This section addresses the question of energy service provision for small-scale enterprises which, although recognised as an important need in poor communities, has not been given sufficient attention in South African energy policy and planning. There are three case studies presented in this section. These case studies focus on the dominant use of woodfuel for income generation in poor urban communities. The case studies mainly survivalist enterprises, including activities that are conducted within a home environment and those that are performed in public spaces. A contrast between the two spaces indicates that traders who operate from public spaces may have greater opportunities than those who are home-based. However, this does not exclude the fact that each environment has its own pros and cons. All three case studies indicate the difficulties facing men and women involved in small-scale enterprises.

6.1 The use of woodfuel for income-generation

As many householders depend on pensions, disability grants, domestic work and other similar kinds of employment where incomes are very low, many people turn to income-generating activities for their livelihoods. Informal income-generating activities are used either to supplement income from these sources or they are the sole source of income. The main energy dependent activities that poor communities turn to include the sale of cooked sheep heads, freshly slaughtered chickens, traditional beer brewing, hairdressing and the sale of cold drinks – soft drinks and beer, and ice licks to school pupils. Activities vary in their energy intensity. For example, those that require heating such as cooking activities are energy intensive than others such as the sale of cold drinks which requires access to cooling facilities.

As electricity is expensive, poor communities mainly use woodfuel for energy intensive income generating activities. In addition to home-based enterprises, many street vendors in the African townships of the Western Cape can be seen along the streets near shopping centres, bus terminus and taxi ranks using woodfuel to prepare food for sale.

6.2 Case study 5: Survival through the sale of cooked food

Nosandile stays with her wheelchair bound husband, Edinburgh and five children in Site B informal planned settlement in Khayelitsha. Due to Edinburgh's disability, the household receives a monthly welfare grant. To supplement this income, Nosandile has been involved in various informal businesses such as the sale of tripe, fruit, sheep intestines and sheep heads since 1990 when her husband began to be ill. When the business gets tough, she looks for domestic work. She would work only for short periods and when she makes enough money to settle her urgent problems, she would return to her business. She said, 'I have been selling sheep intestines for a while, but things have changed. The price of sheep intestines has gone up. It is now difficult to make profit. It is even difficult to increase the sale price because there is so much competition. Customers have a wide choice so they will simply go elsewhere'.

In 1990 when her husband was hospitalised for the first time, she sold sheep intestines. With the money she received from this activity she was able to feed her children, travel to hospital to visit her husband and to bring him food. She sold sheep intestines for a few months in 1996 until her friend advised her about a potential new market in Cape Town. She said that a new construction site in the city offered a lucrative market for sheep heads. After some time, she realised that it would help her to add fat cookies (dough deep fried in oil) to her business.

In her determination to maintain her family, she underestimated the demands of her work. She works very late at night and wakes up early in the morning to prepare fat cookies. When finished, she leaves for Cape Town by train. On the way to the station she carries the sheep heads and fat cookies on her head. When she returns home late in the afternoon, she buys more sheep heads. She prefers to clean them herself to make sure they are properly cleaned. Nobuzwe, her eldest daughter, helps by preparing the dough as well as taking responsibility for cooking and other household chores.

Owing to her failing health, she buys wood which she uses only to prepare sheep heads. Due to severe strain in 1992, she collapsed and subsequently had a brain 'operation'. For this reason she is not allowed to carry anything heavy on her head so she avoids carrying head bundles but has no other alternative to carry her sheep heads and fat cookies to the station.

For other domestic energy needs the household uses paraffin for cooking, water and space heating and lighting in one room. Electricity is used for lighting in the living room, ironing and to power radio and television set.

This case study is an example of a situation where poor people have to find alternative means to supplement their incomes. The income-generating activities that are mentioned in the case study are typical of the choices that poor men and women with less education and therefore poor opportunities for finding employment resort to. A characteristic of these activities is that they attract many people, leading to oversupply of the products and ultimately low profits. In certain cases, as seen in the above case study, this situation can either force people to quit, or motivate them to find other markets. In the latter case, social networks play an important role.

This case study also shows the use of multiple energy sources. Woodfuel is mainly used for income generation, while illuminating paraffin is used for domestic cooking and heating. Electricity is used mainly for less energy-intensive activities such as lighting (though supplemented by illuminating paraffin), ironing and media.

It is important to emphasise that, no matter how poor households are, woodfuel in the low-income urban households of Cape Town is not used for domestic cooking. There are various reasons for this. Firstly, the fact that people are in an urban environment makes it difficult for people to use this energy source comfortably for domestic purposes. As a woman in Site B said 'there is no way I can collect wood in rural areas and then again collect wood in town' (Mehlwana and Qase 1998). This suggested that due to high expectations associated with urban life, most people prefer to buy other energy sources for domestic consumption. There is no social stigma associated with using woodfuel for income-generation and space heating in households that sell traditional African beer.

The following case study is about informal traders operating from a public space. It shows the upgrading and formalisation of the conditions of people involved in various informal activities in Gugulethu, Cape Town. One of the factors to be appreciated in this case study is that a number of local and international donors were involved, including Eskom. Despite the participation of the utility in this initiative, an energy focus has not been prioritised. An important finding from this case study is that people have identified transport as their main energy need.

6.3 Case study 6: Gugulethu Central Meat Market, Cape Town

6.3.1 Background

Gugulethu is one of the oldest black townships in Cape Town. The central meat market has been built in an open space originally used by informal traders particularly from the KwaKhikhi hostels. Informal traders used this space because the community did not want people to sell from around the hostels to avoid making the surrounding environment filthy. Upgrading of this site began in 1996 facilitated by Umzamo Development Project, an NGO working mainly with hostel dwellers in the old African townships namely Langa, Gugulethu and Nyanga East.

6.3.2 Objectives of the project

The main objective is to facilitate skills transfer, job creation, and to provide appropriate facilities for to community needs. Similar to other hostel projects, the emphasis is on the empowerment and integration of hostel residents into the broader community (Mqela 1997).

6.3.3 Community participation and capacity building

Community members were given an opportunity to control and manage the project. To assist local people in managing the project, technical advice had to be simplified by experts and professionals. At the same time, the community continues to get support from NGOs, academic institutions and private sector consultants. Traders will also be trained in financial and project management.

Local labour was used to build the structure that traders use. This created temporary job opportunities for local people, while two other people found full-time jobs, one to manage the market and the other to ensure the site is kept clean. The person responsible for the management of the centre is a woman, while the caretaker/cleaner is a man.

6.3.4 Funding and stakeholders

The community was advised to form a Section 21 company to be able to access funds from prospective donors and other lending agencies. Advisors felt that this structure would make it easier to audit funds, a requirement of one of the funders. One hundred and ten traders of which 90 are women registered the company on 2 December 1996. Since it is an income-generating project, members are allowed to accumulate profit for personal gain.

The total funding allocated for phase one of the project was R1,7 million. Main funders included the Western Cape provincial RDP office, the Cape Town City Council, the British High Commission, Eskom and the Medical Office of Health. The Development Bank of Southern Africa (DBSA) offered a substantial amount in the form of a loan.

6.3.5 Project sustainability

The traders pay rent for the use of the space and so that the building can be maintained. More specifically, meat traders pay R100 per month. Two shop owners pay R450 per month, because their shops include storage space, while others pay R300 per month. The owner of the tavern pays R1 000 per month. Rental depends on the size of space utilised and the type of the enterprise. The board of directors, which includes members of the city council (the city council is the guarantor of the DBSA loan to the project), determines the rent. There is an advertisement board which will generate funds for the company. However, this advertising board is not yet utilised, according to the centre manager (Jack 1998).

6.3.6 Stakeholders involved

A range of stakeholders were involved. These included:

- The Western Cape Provincial RDP Office and Economic Affairs Department is responsible for promoting local economic development, and the development of the small/medium enterprise sector;
- the Gugulethu RDP forum;
- the Gugulethu area committee of the South African National Civic Organisation – SANCO;
- the Section 21 company executive committee;
- the Cape Town City Council;
- the funders.

Energy has not been prioritised in this project, despite the fact that energy is a critical input in many of the enterprises operating in the centre.

6.3.7 Various enterprises operating at the Centre

Whilst the capacity of the centre is enough to accommodate 110 traders, at present there are only 56. Other spaces have not been allocated yet. The majority of traders sell meat (mainly red meat, intestines, tripe, and livers, and sheep heads). Chicken is sold over the weekends, when demand is greater. About five people sell vegetables and fruit. There are seven spaza shops and one tavern.

6.3.8 Energy use patterns and needs

People buy meat to prepare at home, or to *braai* (South African word for barbecue) in the centre. Wood fire is used to *braai* meat in the centre. People who sell sheep heads also use wood to cook them, and, mainly paraffin to clean them. A few people bring their own wood, but others buy wood from wood sellers. Wood sellers often drive pick-up trucks and they deliver wood, except for one man who collects head bundles from Phillipi. No data collection has been done on wood selling.

The main energy need that people identified is transport. Regarding this, many traders buy meat every day from Salt River about 14km away. They were advised to buy meat together so that it can be delivered by one vehicle, but they refused to accept this suggestion, arguing that it may cause confusion. Second, if they have another contractual arrangement with a butchery, it may be too rigid that they are forced to buy regardless of the rate of their sales/income.

Very few enterprises use electricity – it is mainly used in the shops and tavern for refrigeration. A conclusion that can be drawn from these case studies is that people require access to inexpensive and efficient energy sources for a range of small-scale enterprises. Woodfuel is preferred for many enterprises because it is more affordable than electricity.

6.3.9 Challenges

When the meat market first opened at the beginning of July 1998 there were people there selling traditional African beer (commonly known as *umqombothi*). They stopped because, first, they were not making enough profit once they were bound to pay monthly rent. Secondly, the project began during winter. Cape Town winter months are cold and rainy which means there is a need for space heating. Traditionally, in houses where African beer is sold, customers sit around a wood-brazier while drinking their beer. People at the centre felt that they were involved in an unfair competition because there is not enough space for them to have wood-braziers. Customers prefer to drink beer in places where it is warmer. This suggests that by formalising the arrangements in the centre, some benefits of the previous organisation were lost, to the disadvantage of some traders.

The loss of members indicates that the rent for people currently operating from the centre is higher than it would be if the centre was operating at full capacity.

Traders in the centre require assistance to develop their skills in areas such as financial management – mainly book keeping and budgeting. Other skills that have been identified for some people working at the centre include leadership skills, fundraising in order to generate funds and keep rental low, and other skills to retain and improve people's participation in the project. Timing of the training however, is difficult because people are under pressure to make profits and most of them do not regard training to be a priority.

In addition to the energy needs, the experiences in this case study reiterate the fact that working with communities is unpredictable, time consuming and complex.

Woodfuel users have created a source of income for people who have access to transport – and thus in a position to supply wood. This is demonstrated in the case study below.

6.4 Case study 7: Wood traders in Khayelitsha

Sam, a pensioner and traditional healer shares a two-roomed house in Khayelitsha with his wife, seven children and a grandchild. Although he could not disclose how much he receives from healing, it appears that this income, together with his monthly pension of R410 is not sufficient to maintain his large family. In January 1996, he went into a joint venture with a friend who is of the same age (both are in their late 70s) to sell wood. They pooled money and bought two donkeys at R50 each and a cart at R150. They bought donkeys because horses, even though they are stronger, are expensive. A horse costs about R1 700.

Wood is collected at a 'forest' near Blackheath about 8km away, meaning access to transport is essential. The men usually leave at 8am to collect wood and return late in the afternoon. When they arrive home, they cut wood logs into small pieces and sell them to people involved in income-generating activities using wood. They collect wood five times a week, allowing themselves time to rest over the weekend. When the sales go well, Sam earned R400 a month as an additional income for his household. This money is used to buy household essentials, and usually the first priority is food. The two men sell wood at R50 to R60 a load and the income generated is divided between them.

In February 1997, the two stopped selling wood because it had become too far to travel to the 'forest'. Sam feels that he can no longer walk long distances because of his age. Also, one donkey died and it became difficult for one donkey to pull the heavy cart. Indeed, when they tried to use one donkey, they were fined R500 for maltreatment of the animal. Rather than paying the fine, they stopped collecting wood.

6.4.1 Advantages of using woodfuel

Firstly, woodfuel is used primarily for income-generating activities. This can make it easier for people to account separately for their energy expenditure. This is particularly important for people who operate home-based enterprises. Secondly, woodfuel is used strategically for activities that require long hours of cooking and boiling such as traditional beer brewing and the preparation of sheep heads for sale. Thirdly, unlike other energy sources, woodfuel can be collected at no financial cost. This makes it more affordable than commercialised energy sources, except that there are opportunity costs in terms of women's time – women are mainly responsible for collecting wood.

6.4.2 Opportunities

The energy needs of people involved in small-scale enterprises are not fully understood, that is the collection, supply, quantities, and turnover have not been documented. However, opportunities are there to explore these questions and assess the potential demand for fuelwood in urban areas.

There is also an opportunity to build on local knowledge – the fact that people use woodfuel mainly for energy-intensive activities can be a critical step for introducing energy efficiency/ conservation in these activities.

There are no plans yet to improve access to woodfuel resources in urban areas. These resources are diminishing as more houses are constructed and other development projects are established. The case studies clearly indicate that this energy source is an important input in the livelihood strategies of poor communities. Woodfuel users in urban areas of South Africa are perceived to be a minority, but these case studies highlight that this may not necessarily be the case. Instead, it is related to the fact that energy needs for small-scale enterprises are not yet understood.

6.4.3 Environment, health and safety constraints

Firstly, the use of woodfuel is very demanding in terms of human energy. Women carry head bundles over long distances, putting their health at risk. The health risks associated with wood collection include backaches and exposure to harmful emissions from wood burning. Secondly,

woodfuel collection in urban areas is risky in that people often cross freeways where cars are being driven at high speed, putting their lives in danger.

Due to increasing urbanisation, woodfuel resources are competing with the need for building houses and other community structures for land. Given this situation, woodlands are being cleared, making the task of wood collecting more demanding as wood resources are pushed further and further away from the users. This means that prices of woodfuel will go up. This situation has the potential to force people to stop collecting it, since the main attraction of woodfuel is that it is cheaper than other energy sources.

7 Conclusion

An issue is to consider whether development projects such as the national electrification programme have as their goals the holistic development and empowerment of the community and why, or whether, the goal is the delivery of services to meet political and social expectations. The electrification programme has been criticised for being target-driven, but whether community empowerment is the responsibility of Eskom is still being debated. Either decision will have particular consequences and will affect the implementation process. Had suppliers engaged in participative processes, targets may not have been met and there would be fewer connected households and less political satisfaction. Choosing a primary goal is not necessarily the responsibility of the service provider; nor does it exclude elements of the alternative route, but it may avoid some of the disappointment and confusion associated with participatory development, such as was evident in case study 4.

Improving access to energy services for the urban poor is a relatively new concept in South Africa, and thus far the primary initiative has been the electrification programme. However as this report shows, electrification alone is not sufficient. Multiple fuel use will continue in the medium term and informed energy choice and mix may be a more realistic goal than the transition to higher order fuels. Securing woodfuel in urban areas for example is important for the 'poorest of the poor'. More recently, there has been growing interest and funding for renewable energy projects which may provide sustainable alternatives if affordable pricing and quality can be assured.

Key issues to be addressed in order for poor urban communities to access higher grades and more sustainable forms of energy are the lack of essential services, unemployment, transport, multiple fuel use, political will, and education. Although these may seem disparate issues, together they constitute a coherent approach to the development of sound urban energy provision.

Essential services

Urban energy provision does not make sense without attention to water, sanitation, housing, roads, schools, clinics and telecommunications.

Unemployment

Lack of employment and/or cash income is debilitating in a cash society. At a minimum, survivalist activities which give meaning to personal endeavour should be facilitated. Energy is just one input among several needed to ensure the continuation of such activities. Integrated development, vertical and horizontal liaison and planning would be ideal.

Transport

Transport, or rather lack of convenient and affordable public transport, was identified by several of the informal traders as a priority need.

Multiple fuel use

Despite the desirability and the success of the mass electrification programme, the reality of multiple fuel use must be accepted and addressed constructively. For example, accepting the reality of fires in informal shack settlements may prompt the installation of fire hydrants and access roads.

Affordability

South Africa has been able to afford massive subsidies in the electrification programme but such financial assistance has not been afforded other energy sources. At household level people are still unable to afford to pay for electricity.

Political will

There is, at least in rhetoric, an acceptance of the need to address the inequities in our society. Organs of civil society need to be empowered to maintain the pressure on the government to deliver according to its electoral promises.

Education

The White Paper on Energy Policy for South Africa 1998 commits itself to a programme of education and information dissemination for all levels of society in matters pertaining to the energy sector. Some initiatives such as the Soul City project, a series in print and on television series are beginning to address energy efficiency and conservation issues.

7.1 Recommendations

7.1.1 Low cost electrification

- Continue installing the pre-payment system in an ongoing electrification programme so that all urban households are electrified within the foreseeable future. With reference to informal housing, this will require securing tenure at a more rapid rate, while in backyard shacks owners are unlikely to be willing to install separate meters for tenants because their power would be reduced.
- Provide adequate wiring in all new low-cost housing;
- Provide training for 'street electricians' in order to encourage entreprenurial enterprise, to ensure dwellings are safely wired, and to promote the use of electricity for lighting in exisiting structures.
- Find ways of reducing interest rates on HP for low-income households.
- Consider making energy efficient fridges and cooking appliances VAT free.
- Investigate safety labelling for new and second hand appliances.
- Increase the expiry warning period, or put a warning alarm on pre-paid electricity meters.
- Encourage payment and discourage bypassing through education and ethics.
- Ensure an equitable distribution across provinces.
- Research the energy needs of people in CBDs
- Facilitate community participation in the setting of targets.

7.1.2 Energy efficient initiatives

- Do more research and development work, and more testing of technologies to make these affordable.
- Promote the use of inexpensive forms of solar water heating (not necessarily big systems).
- Promote the concept of thermally efficient housing at all levels. Officials, developers, financiers and communities are largely unaware and slow to make use of the advantages of passive solar design.
- Incorporate local knowledge and experience of using a variety of waste and readily available materials for insulation into low-cost housing planning.

The White Paper on Energy Policy of South Africa 1998 makes a broad commitment to promoting energy efficiency awareness in households, and facilitating the establishment of relevant standards and codes of practice for the thermal performance of dwellings. A key issue to be addressed would be how to hold the Department of Minerals and Energy to these intentions, and to present possible strategies to accomplish this.

7.1.3 Small-scale enterprises

- Investigate all aspects of urban wood use for small-scale enterprises with the objective of securing its future. At this stage it not yet known where it comes from, how much is available, what kind of wood is being collected, who uses how much, what for and at what stage substitution might take place. All these are questions that are still to be answered.
- The socio-economic costs as well as the health and safety hazards of wood use need to be made explicit in order to determine possible interventions.

The continuing use of wood in urban areas indicates a need for access to more affordable energy services.

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